VERTICAL DISTRIBUTION OF ANCHOVY EARLY STAGES IN THE ALBORAN SEA: VALIDATING TOOLS FOR IBM ECOLOGY IN A REGIONAL CONTEXT

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Abstract

We offer the first data on vertical distribution of anchovy larvae (*Engraulis encrasicolus*) in the Alboran Sea. Preliminary results show that the vast majority of anchovy larvae distributed in the top 25 m during daytime, suggesting either a lack of vertical migration or a type II migration. Data are discussed in the frame of the potential implications of vertical migration data for spatially-explicit individual-based model escercises being implemented in the area

Keywords: Alboran Sea, Models, Fisheries, Ichthyoplankton

Introduction

Vertical migration of fish larvae is likely to affect their probability of survival. In European anchovy (EA) *Engraulis encrasicolus*, type I vertical migration, implying nocturnal ascent and diurnal descent, has been described in the NW Mediterranean [1]. However, evidence suggests that this is not a species-specific strict behaviour but it may be influenced by the environment: for EA in Benguela, Olivar [2] and Stenevik et al. [3] found either no evidence for vertical migration, with all larvae being at the top 25 m, or a type II (oposite to Type I) vertical migration. This was related to either the presence of a strong thermocline or the avoidance of an offshore Eckman transport layer. Anchovy populations living in the vicinity of the Strait of Gibraltar dwell in coastal areas heavily influenced by the Atlantic Jet, which provokes high mesoscale variability and mixing of Atlantic and Mediterranean waters. Historically, there has been a drastic reduction in the anchovy population hypothetically caused by the combination of man-induced pressure in an area of relatively localized spawning area, together with changes in production processes. Within the SESAME EU project, one case study tackles the analysis of EA changes in abundance through environmental and human forcings in the Alboran Sea. Through the combination of Individual-based models coupled to circulation models, we try to understand the underlying processes regulating mid and long-term fluctuations in the populations. Gathering *in situ* data like vertical migration or growth is one step towards building and validating these models. The objective of this work was to analyse the vertical distribution of anchovy early stages in a coastal area where it spawns, and to interpret the results in the frame of existing dispersion models and vertical distribution data.

Material and Methods

A first excercise to identify the zones in the North Alboran Sea with higher retention probability was perfomed using the outcome of a 3D ROMS (www.myroms.org) ocean climatology of 30 years averaged each 8 days (2 km resolution in the Alboran Sea, MFS used as boundary conditions and ERA-40 for meteorological forcing). The package Ichthyop (www.eco-up.ird.fr/projects/ichthyop) was used to simulate the transport of inert particles from 13 different areas during 12 climatological months. Each monthly run consisted on 65000 particles released between the 50 and 100 m isobath, which drifted for 30 days. They were set to recruit if they spent over 1 day over the 50 m isobath at ages older tan 14 days. To obtain vertical distribution data, an ichthyoplankton-oceanographic survey was conducted in 2008 over the potential spawning zone of EA (Fig. 1). From the 27 stations, preliminary data from the vertical distribution of anchovy eggs and larvae was analysed from 12 stations located at the areas of higher retention, close to Malaga Bay. Vertical distribution was derived from a multinet (HydroBios, 50x50) equiped with 200 microns mesh and set to operate at 25m intervals from 100 m to surface. Plankton samples were preserved in seawater with 4% formalin buffered with Borax. All fish species were sorted and EA eggs and larvae were kept separate for later analysis. The preliminary results shown here correspond to mean abundances per stratum of stations collected during daytime, using stations for which at least the top 2 depth ranges were available.

Results and Discussion

The results of the dispersal model showed that 1) the area close to Malaga Bay showed a significantly higher probability of retention than adjacent zones in the N Alboran Sea, and 2) that this retention was higher from April to September, coinciding with the spawning period of the EA. The surveyed area area was characterised by the presence of mixed Mediterranean-Atlantic waters of 36.6-37at surface, and of Mediterranean waters at deepre layers (Fig.1 A). The signal of the Western Atlantic Gyre, was visible at station 6 from the coast (Fig. 1 A). A strong shallow thermocline at ca. 25 m was present in the area. From the 10987 larvae found, anchovy represented only 1.23 % (135 ind). Eggs were found in low numbers (54) in the vicinity of Malaga Bay, suggesting a very local and patchy spawning, which confirms earlier works [4]. Eggs and larvae agregated in the top 25 m, diminishing sharply afterwards (Fig. 1 B), in relation to the presence of the strong thermocline. The data for Fig. 1 were collected during daytime: although these results are preliminary, there was no evidence to suport the view that larvae performed significant type I migration. We provide the first data on vertical distribution of anchovy in the Alboran Sea. Further analysis of size-based data, and diel rithms will shed more light into the mechanisms driving vertical behaviour in this area, and will be an added value for the spatially-explicit IBM excercises that are being implemented.

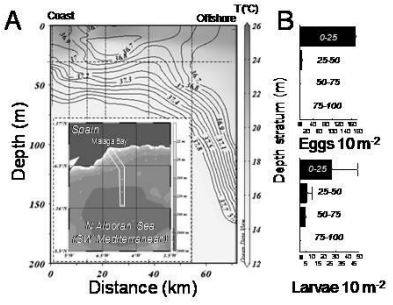

Fig. 1. (A) Salinity (contour) superimposed on a temperature profile (shaded) from a transect of the N Alboran Sea. (B) Median vertical abundances and IQ ranges of anchovy eggs and larvae from positive stations. In A, the stations (dots), transect (rectangle) and the aproximate location of the thermocline (horizontal dashed line) are indicated

References

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